

Sorting out Compositional Trends in Sedimentary Rocks of the Bradbury Group (Aeolus Palus), Gale Crater, Mars

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Introduction

The Supplementary data tables provide the Alpha Particle X-ray Spectrometer (APXS) compositional data for all targets analyzed by the Curiosity in the first 860 sols along with the associated MAHLI image number, the textural classification based on this study, the characteristics of the analysis, and the calculated mineral compositions for targets included in this study based on the Monte-Carlo mass-balance method described in the text. Details for each table are included in the captions below.

Table S1. APXS rock compositions and errors. This table includes all of the APXS targets analyzed by Curiosity in the first 860 sols, not just the targets that were included in this study. The targets are listed along with the sol (Martian day) when the APXS composition was acquired, the textural category that was determined in this study, the PDS image number and pixel scale for the 5 cm standoff MAHLI image of the target, some details of the target acquisition (e.g., repeat targets, overlapping targets, or targets from which dust was removed), the reported composition of the target (wt% for major and minor oxides, ppm for trace elements), and the reported statistical errors for the compositions. Listed textural categories include the textural categories described in the manuscript: “igneous” = possible igneous, uncertain, conglomerate, sandstone, fine sandstone, sheepbed = Sheepbed mudstone, murray = Murray mudstone, and diagenetic, and the column also includes categories that were excluded from the paper, including: soil (analyses of regolith), drilled (analyses of powders produced by drilling), and excluded (three sandstone targets within the Mt. Sharp group). Detailed notes are available at the bottom of the table.

Table S2. Synthetic compositions used to test the mass balance routine. Bulk compositions calculated using the “Input phase fractions” and fixed molar Mg/[Mg+Fe] (Mg#) values for olivine, augite, and pigeonite (0.5, 0.55, and 0.6, respectively); the cation fractions of CaO in augite and pigeonite were also held constant at 0.1805 and 0.0495, respectively. The Mg#s and CaO values yield Wo-contents of 0.379 and 0.102 for the high- and low-Ca pyroxenes. Chromite and ilmenite compositions were also held constant for all six synthetic samples (chromite and ilmenite Mg#s were 0.3 and 0.2, respectively). The other major and minor elements in these five phases were selected so as to be consistent with the relationships between Mg# and the other cations in each phase based on the compositions of minerals in martian meteorites and stoichiometric constraints (see main text and Appendix A2 for further discussion). Composition of the K-feldspar (Or₉₅) was also held constant. For plagioclase, the following An values were used: 0.45, “igneous”; 0.4, uncertain, sandstone, fine sandstone, and Sheepbed; 0.35, conglomerate. The Or and An values defined the compositions of the feldspars in wt%. The average calculate phase fractions (and 1 sigma values) are based on 25 runs for each bulk composition, where a given run consists of 200,000 mass balance calculations; for each calculation, Mg#s for olivine, augite, pigeonite, chromite, and ilmenite, Ca (cation fraction) for augite and pigeonite, an An number for plagioclase, and an Or number for K-feldspar are selected randomly from the following bounds: 0.33–0.65 olivine Mg#, 0.46–0.82 augite Mg#, 0.50–0.78 pigeonite Mg#, 0.1–0.215 augite Ca, up to 0.09 pigeonite Ca (the lower Ca bound is a function of Mg#), 0.05–0.45 chromite Mg#, 0–0.3 ilmenite Mg#, 0.2–0.7 plagioclase An, and 0.9–1.0 K-feldspar Or. The other major and minor cations in olivine, pyroxenes, chromite, and ilmenite are again pulled from mineral data on martian meteorites (using the selected Mg#s as constraints). The bounds on Mg#, An, and Or are based on a combination of CheMin data and mineral compositions in martian meteorites. The best-fit set of phase proportions for each run of 200,000 calculations was that set with the lowest Chi² value.

Table S3. Input bulk compositions and output mineral modes for targets in each of the categories discussed in the main text. Targets were reordered by textural category. Red text is used for “repeat” targets, which were not included in the text or in Figure 9. Bulk compositions are normalized to 100 wt% after converting Ni (ppm) to NiO in wt% and setting SO₃ and Cl values to zero. Calculated mineral phase fractions (by wt) are the average of the output of 25 runs, where each run consisted of 200,000 calculations. Q is the probability that the computed Chi² based on the fit should exceed a particular Chi² value for the given number of degrees

of freedom. Mass balance fits that generated Q values <0.05 failed at the 95% confidence level and the phase proportions are not reported. Analyses with no Q values were not mass balanced due to either very high SO_3 or MnO contents.